

## The Exotic Herpetofauna of Southeast Florida

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IN 1910 Barbour reported the first successful invasion of south Florida by an exotic species of amphibian, *Eleutherodactylus planirostris*, and in 1922 Stejneger reported the first exotic reptiles, *Hemidactylus turcicus* and *Sphaerodactylus cinereus*, to be established in the state (see also Fowler, 1915). By 1940 the list of exotics had increased to eight species (Carr, 1940), and by 1957 to twelve (Duellman and Schwartz, 1958). The introductions come from three sources, accidental importation on produce shipped into the state, escape from wholesale animal dealer-importers, and the intentional release of animals. The last two sources account for the rapid increase in the rate of herpetofaunal introductions since 1945. The success of many of the introductions results from south Florida's semitropical climate and flora and depauperate fauna.

This paper lists the exotic species that have been introduced into south Florida, delimits their present local ranges, and records how each was introduced, when known. The animals are treated in three groups, species established and breeding, species not known to breed locally, and species unreported since their release.

### ESTABLISHED BREEDING SPECIES

The giant toad, *Bufo marinus*, was first reported in southeast Florida by Neill (1957). Duellman and Schwartz (1958) listed *B. marinus* in the "... western part of Miami, Dade County, 17 May 1955." The present population is not the result of an introduction near Pennsuco prior to 1958 (see Duellman and Schwartz, 1958; Riemer, 1959), but results from the accidental release of approximately 100 specimens by an importer formerly located at Miami International Airport, whence the species has spread. Other animal dealers deliberately released the species in 1963 at Pembroke Park, Broward County, and in 1964 at Kendall, Dade County. The Kendall animals came from Surinam; all others were from Colombia. The present distribution of *B. marinus* in Florida extends from Homestead in southern Dade County, north to Pembroke Park and Hollywood in Broward County, and from the Intracoastal Waterway west to the Everglades.

The greenhouse frog, *Eleutherodactylus planirostris planirostris*, from Cuba, has been recorded throughout most of south Florida (Barbour, 1910; Deckert, 1921; Carr, 1940; Goin, 1947; Neill, 1957; Duellman and Schwartz, 1958). It is abundant throughout the Florida Keys and the eastern half of Dade, Broward, and Palm Beach counties. Its introduction was probably an accidental consequence of ship commerce.

The giant treefrog, *Hyla septentrionalis*, from Cuba and Hispaniola, occurs from Key West in southern Monroe County, where it was first recorded, northward along the eastern half of Dade and Broward counties to Dania (Barbour, 1931; Trapido, 1947; Wright and Wright, 1949; Peterson, Garrett, and Lantz, 1952; Schwartz, 1952; Allen and Neill, 1953; Duellman and Schwartz, 1958; King, 1960). Eggs and tadpoles of this frog are found in many outdoor fishponds and swimming pools in southeast Florida. Its initial introduction seems to be an accident of shipping.

The yellow-headed gecko, *Gonatodes albogularis fuscus*, was established in Key West prior to 1939 (Carr, 1939, 1940; Duellman and Schwartz, 1958) and is still abundant there today. By 1965 a reptile fancier had secondarily introduced it into Dade County, in the vicinity of Day Avenue and Matilda Street, Coconut Grove. This species probably was introduced to Key West on shipments from Cuba or Jamaica.

The Indo-Pacific gecko, *Hemidactylus garnoti*, was introduced into Dade County prior to 1964. This species is established in two widely separated locations, in the immediate vicinity of 3811 Wood Avenue in Coconut Grove, and 19 Terrace between 70 and 73 Courts SW, Miami. As both localities are homes of University of Miami Institute of Marine Science personnel, the introduction may have resulted from the International Indian Ocean Expedition (1960-1963).

The Mediterranean gecko, *Hemidactylus turcicus turcicus*, has been reported primarily from Key West and Big Pine Key, Monroe County (Fowler, 1915; Stejneger, 1922; Barbour, 1936; Duellman and Schwartz, 1958; King, 1959). In the Miami area it occurs in several localities, 22 Street and 3 Avenue NE, and along NW South River Drive between 42 and 27 Avenues NW. Whether these are isolated populations, or part of a single widespread population, is not known to us. A reptile fancier established one disjunct colony in the vicinity of 9885 SW 80 Drive, Sunset Park.

The mainland populations are undoubtedly secondary introductions from the Key West colony, and the latter probably was an accident of shipping.

The ocellated gecko, *Sphaerodactylus argus argus*, was reported from Key West, Monroe County, by Savage (1954). Duellman and Schwartz (1958) were unable to find the colony in Key West, and therefore reported it no longer extant. The colony, however, was located on the western end of the island near the aquarium as recently as 1964. These animals could have been introduced in shipments from Jamaica or North Bimini, Bahamas.

The ashy gecko, *Sphaerodactylus cinereus*, a Cuban and Hispaniolan species, was first reported from Key West by Stejneger (1922). Duellman and Schwartz (1958) report that the colony is thriving on Key West, and that *S. cinereus* also occurs on Boca Chica Key, Monroe County. These are the only populations known to us. While *S. cinereus* is restricted in distribution, *Sphaerodactylus notatus* is widespread both in the Florida Keys and on the mainland. These distributions led Duellman and Schwartz (1958) to believe that *S. notatus* is an indigenous member of the Florida fauna, a conclusion with which we agree.

The Bahamian bark anole, *Anolis distichus distichus*, was initially discovered in Brickell Park, Miami, in 1946 (Smith and McCauley, 1948; Duellman and Schwartz, 1958). This lizard is abundant in the Miami area from the Miami River south to Kendall, and from the Atlantic shore to West Miami. In addition, it occurs on Key Biscayne in the area of Crandon Park Zoo. It is most abundant in Coconut Grove and Coral Gables. The first population almost certainly was a deliberate release. In Coconut Grove the species has spread without human aid, but virtually all other populations result from secondary introductions by reptile fanciers. In life, this race has an ash-gray dorsal groundcolor and a pale yellow dewlap.

The green bark anole, *Anolis distichus dominicensis*, a Hispaniolan race, occurs in a small colony in Miami, along the Tamiami Canal near 32 Avenue and 24 Street-Road NW. It was most probably accidentally introduced on a freight boat that trades between the Miami River and Hispaniola. In life, this race has a pea-green or gray-green dorsal groundcolor and a pale orange dewlap.

The knight anole, *Anolis equestris equestris*, from Cuba, was

reported in south Florida by Neill (1957). The main colony, and area of first introduction, is centered in a twenty city block area of Dade County, Coral Gables, from Coral Way in the north to Bird Road in the south, and from Le Jeune Road on the east to Segovia Avenue on the west. Secondary releases occurred in Coconut Grove in the vicinity of Day Avenue and Matilda Street; in Coral Gables on Old Cutler Road near Matheson Hammock; in Sunset Park in the vicinity of 9885 SW 80 Drive; and in Peters at US Highway 1 and Eureka Drive. It is also reputed to be on Key Biscayne; in Brickell Hammock on the grounds of the Viscaya Museum; and in Broward County, in the vicinity of Davie, but this has not been confirmed by us. The original introduction was made in 1952 by a student in the University of Miami Department of Biology, whose buildings are in the center of the main population. The subsequent spread was accomplished by reptile fanciers, who feared that the species would become "extinct" in Miami.

The Bahamian ground anole, *Anolis sagrei ordinatus*, was reported to occur in a six block area adjacent to Shenandoah Elementary School at 1023 SW 21 Avenue (Bell, 1953). This locality now supports a colony of *Anolis sagrei sagrei*. Duellman and Schwartz (1958) do not list *A. s. ordinatus* from the Miami area, and we suggest that if *A. s. ordinatus* occurred at Shenandoah School, it was never abundant there. Oliver (1948; see also Carr and Goin, 1955) reported *A. s. ordinatus* from Lake Worth city, Palm Beach County. A small colony also exists in South Miami, in the vicinity of US Highway 1 and 61 and 62 Avenues SW. Although the Lake Worth introduction was deliberate, the South Miami population seems to have been derived from accidental introduction on Bahamian shells and corals sold at that location. In life, males of this race have a pale brown to ash-gray dorsal groundcolor and a dewlap with a mustard-yellow groundcolor.

The Cuban ground anole, *Anolis sagrei sagrei*, has been collected from Key West, Miami, Tampa, St. Petersburg, and West Palm Beach (Barbour, 1931a; Oliver, 1950; Duellman and Schwartz, 1958; King, 1960; see also Ruibal, 1964, for the synonymy of *A. sagrei stejnegeri* with *A. s. sagrei*). This species abounds throughout most of metropolitan Dade, Broward, and Palm Beach counties, and in Key West and Cudjoe Key, Monroe County. Its present distribution is the result of at least three separate accidental



introductions into Florida ports—Key West prior to 1931; Port of Palm Beach, 1960; Port Everglades (Broward County), 1964. From these initial populations, the species has spread by secondary releases and by its own abilities to compete and increase its numbers until today it is one of the most successful reptiles in south Florida. In life, males of this race have a rust-brown to ash-gray dorsal ground color and a dewlap with a red ground color.

The curly-tail lizard, *Leiocephalus carinatus armouri*, from the islands of the Little Bahama Bank, was first reported in Palm Beach County (Duellman and Schwartz, 1958; King, 1960). Another race, *L. c. virescens*, occurred in Miami prior to 1940 (Barbour, 1936; Carr, 1940), but died out shortly thereafter. Colonies of *L. c. armouri* occur in Dade County on the grounds of iMami Seaquarium on Virginia Key, and Crandon Park Zoo on Key Biscayne. Both colonies were produced by deliberate releases by the personnel of these institutions. In addition, *L. carinatus coryi* from Bimini, Bahamas, is believed to be present at Crandon Park Zoo, although we have been unable to collect any. The Palm Beach population is still extant.

The Colombian ground lizard, *Ameiva ameiva petersi*, was first reported by Duellman and Schwartz (1958; see also Neill, 1957) from 34 Avenue and 79 Street NW, Miami. This colony began when animals escaped prior to 1954 from an animal importer formerly located at that locality. They are believed to have come from Colombia. Since that time, the colony has occupied an area of about 25 city blocks, from 79 Street NW, Miami (E 25 St., Hialeah), south to 76 Street NW, Miami (E 22 St., Hialeah), and from 36 Avenue NW, Miami, west to E 8 Avenue, Hialeah (Le Jeune Rd.). This is an area of weed-filled vacant lots, railroad right-of-ways, and residential lawns and gardens.

#### ESTABLISHED NON-BREEDING SPECIES

The second group includes established species for which we have no evidence of breeding at the time of this writing. These colonies may exist only as long as the adult animals live, or evidence of breeding might be found at some later date.

The red-eared turtle, *Pseudemys scripta elegans*, from the northern United States, is concentrated in a small canal in Miami

bordering the Little River Canal, located at 107 Street at 18 Avenue NW. Adult specimens were collected for us by children from this locality. Another colony exists in the canals in the area of Crandon Park Zoo, Key Biscayne. Both colonies resulted from deliberate releases.

The spectacled caiman, *Caiman sclerops*, is found as a feral pet in the various canal systems in and adjacent to cities in south Florida. It has been found as far north as Palm Beach County. It appears to successfully overwinter, but nests have not been found. This species is imported in large numbers from Colombia, and is a common item in many tourist shops throughout Florida.

The Tokay gecko, *Gekko gekko*, from southeast asia, is present in the immediate vicinity of 3310 NW South River Drive, Miami. At least three specimens of unknown sex were released prior to 1965 by an animal importer at this locality in an attempt to control roaches in the buildings. In addition, four or five specimens were released by a reptile fancier in the vicinity of Day Avenue and Matilda Street, Coconut Grove, although we have been unable to discover the species at this locality.

This species has also been introduced into north Florida. In August 1963, a professor in the University of Florida released two adult females and one adult male *Gekko gekko* on his house in Gainesville, Alachua County, Florida. Two more of unknown sex were released October 1964. They survived two winters with a low temperature of  $-11^{\circ}\text{C}$ . As of April 1965, at least one male and one female were alive, but there was no evidence of young.

The rhinoceros iguana, *Cyclura cornuta cornuta*, from Hispaniola, was introduced, as part of an exhibit, to several "islands" at Miami Seaquarium, Virginia Key, Dade County. Several of these animals have escaped from this exhibit and are frequently seen running around the grounds of the Sequarium. Additional specimens reportedly have been seen on nearby Key Biscayne.

The green iguana, *Iguana iguana iguana*, is a frequent escapee from animal dealers and reptile fanciers. The species appears to survive and grow quite well, but the occasional winter frost probably eliminates most of the population. Areas of concentration in the Miami area are near W 27 Street and E 7 Avenue, Hialeah; in the vicinity of Caballero Boulevard and Hardee Road, Coral Gables; in the southwest corner of Miami International Airport; and on Key Biscayne. At the first of these localities over

300 individuals were released by one animal dealer between May and September 1964. Most of these animals are imported from Colombia.

The Texas horned lizard, *Phrynosoma cornutum*, from the southwestern United States, appears occasionally in south Florida. The species has been recorded from Dade, Duval, Escambia, Indian River, Lake, Marion, Orange, Polk, and Putnam counties (DeSola, 1934; Goff, 1935; Carr, 1940; Carr and Goin, 1955; Allen and Neill, 1955). The species was successfully breeding in north Florida on Fort George Island, Duval County, as of September 1953. Several individuals were released by a reptile fancier prior to 1964 in Dade County, in the vicinity of 9885 SW 80 Drive, Sunset Park, and over 100 specimens were released between May and September 1964 by an animal dealer in Hialeah, near W 27 Street and E 7 Avenue. Finally, a small colony near NW South River Drive and 33 Avenue, Miami, resulted when animals escaped from an animal dealer at that address. One specimen was also collected in southwest West Palm Beach, Palm Beach County.

The South American ground lizard, *Ameiva ameiva ameiva*, is established in Dade County, Kendall, in the immediate vicinity of 78 Avenue and 125 Street SW. Approximately eight adults were imported from Surinam by an animal dealer and released near his house prior to 1964. Numerous reports place this species on Elliott and Little Arsenicker Keys, Dade County, but we have repeatedly been unable to obtain specimens from these islands. Six specimens were also released in 1964 by an animal dealer in Hialeah near W 27 Street and E 7 Avenue.

The boa constrictor, *Constrictor constrictor*, is collected infrequently in cities in south Florida. These snakes are undoubtedly feral pets, although one reptile fancier released juveniles along Loop Road (State Highway 94) in an attempt to establish it in the Everglades. Nowhere, to our knowledge, is there a center of concentration for this species. Several races are imported by the animal dealers in south Florida.

#### SPECIES UNREPORTED SINCE RELEASE

The third group consists of species which were released in sufficient numbers to have become established, but which have not been found by us since. As the list of species is long and the

number of localities is small, we will list these by locality. The approximate number of individuals released is given preceding each species name.

In the vicinity of W 27 Street and E 7 Avenue, Hialeah, including the adjacent Hialeah (Red Road) Canal, an animal importer at that address released the following species between May and September 1964: SALAMANDER:—200 *Notophthalmus viridescens viridescens*, 200 *Triturus pyrrhogaster*; FROG:—1000 *Hymenochirus boettgeri*, 200 *Xenopus laevis*, 10 *Agalychnis dacnicolor*; TURTLES—25 *Kinosternon scorpioides*, 25 *Chrysemys picta belli*, 25 *Chrysemys picta dorsalis*, 100 *Graptemys pseudogeographica kohni*, 20 *Pseudemys dorbigni*, 20 *Pseudemys scripta callirostris*, 150 *Pseudemys scripta ornata*, 10 *Podocnemis lewyana*, 10 *Podocnemis sexituberculata*, 250 *Podocnemis unifilis*; LIZARDS—10 *Cordylus cordylus niger*, 6 *Sceloporus magister*, 60 *Sceloporus poinsetti*, and 40 *Cnemidophorus picturatus*. Most of these animals were released rather than destroyed, when they became sick and unsuitable for sale. A few were released rather than to glut the market for a commercially rare species. During 1946, reptile fanciers released 48 juvenile *Pseudemys malonei*, from Great Inagua, Bahamas, into this canal (Hodsdon and Pearson, 1946), but the exact site of release is not known.

In the vicinity of Pembroke Road and US Interstate Highway 95, Pembroke Park, Broward County, prior to 1964, an animal dealer released the following species: FROG—6 *Bufo blombergi*; TURTLES—5 *Chelus fimbriatus*, 20 *Pseudemys scripta ornata*; and LIZARDS—4 *Basiliscus basiliscus*.

At 9550 SW 67 Avenue, Kendall, Dade County, the owners of a plant nursery released an unknown number of the Panamanian frog, *Atelopus zeteki*. This species was last seen at this locality three years ago.

In the vicinity of 84 Street and 100 Avenue SW, Sunset Park, Dade County, prior to 1965, a herpetologist released a small number of West Indian species: FROG—*Eleutherodactylus portoricensis*; LIZARDS—*Hemidactylus brooki*, *Sphaerodactylus macrolepis*, *Anolis conspersus conspersus*, *Anolis cybotes cybotes*, and *Anolis distichus ignigularis*.

#### DISCUSSION

If such wholesale introductions continue, they will have a detrimental effect on the native fauna of Florida, for when the intro-



duced animal competes for a niche already filled by a native species, the result can be the elimination of the latter. Indeed there is evidence that the native species of *Bufo* and *Anolis* are being adversely affected by competition from *Bufo marinus* and the many introduced anoles.

It is our sincere hope that such introductions will be stopped before an exotic amphibian or reptile undergoes a population explosion, as has occurred with certain mammals and birds. It is to prevent just such an occurrence that the State of Florida prohibits unauthorized introductions (Florida Administrative Code, 1962, Chap. 165-16), and yet none of the above introductions were made under State permit. If introductions are to occur, we hope they will be made by responsible biologists only after extensive studies have determined that the introduced species will not compete severely with the native fauna.

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